PROBLEMS FOR SOLUTION.

ALGEBRA.

369. Proposed by WILLIAM HOOVER, Ph. D., Athens, Ohio.

If $f(m)=(1+x)^m$, and $f(n)=(1+x)^n$, why not obviously $f(m).f(n)=(1+x)^{m+n}=f(m+n)$?

370. Proposed by E. B. ESCOTT, University of Michigan, Ann Arbor, Mich.

Prove that, if the fraction m/p (p prime) gives a recurring decimal with an even number of digits in the cycle, the sum of the two halves will be composed of 9's. (The special case where the number $=p-1$ was proposed in the MONTHLY, Vol. IV, and answered in Vol. V, p. 11. The proof there given, however, is not complete.) The above property is true of other fractions, *e. g.*, $\frac{1}{77}=.\dot{0}12987\dot{}$, $\frac{1}{133}=\frac{1}{7.19}=.\dot{0}07518796,992481203\dot{}$. Find for what fractions this is true.

371. Proposed by ELMER SCHUYLER, Brooklyn, N. Y.

In a G. P. of an odd number of terms, all of the terms being positive, and the ratio different from 1, show that the middle term is less than the arithmetical mean.

372. Proposed by S. LEFSCHETZ, Ph. D., University of Nebraska.

Prove that $\sum_{n=1}^{n=\infty} n^2x^{n-1}=\frac{1+x}{(1-x)^3}$, if mod.$x<1$. (*Schlömilch.*)

373. Proposed by X, National Electric Light Association, Brooklyn, N. Y.

(a) For underground distribution of direct current electrical energy, we have $DA^n-CB^n=H$, where the only unknown is n, which represents the number of years it will take a large direct current low tension feeder to pay by line loss saving for the increased investment over a smaller feeder.

(b) $bVf^2l^2\beta^2+aVf\beta^{1.6}=W$, the iron loss equation which is to be solved for β. When $bVf^2l^2\beta^2$ represents the eddy current loss in the core of a transformer, and $aVf\beta^{1.6}$ is the hysteresis loss in the core. a, b, and l are constants of the core, V is the voltage, f is the frequency, and β is the flux density and is the only unknown in the equation.

Letting $bVf^2l^2=A$, and $aVf=C$, we have $A\beta^2+C\beta^{1.6}=W$.

GEOMETRY.

401. Proposed by F. H. SAFFORD, Ph. D., The University of Pennsylvania.

Find by Euclidean geometry a point whose distances from the vertices of an equilateral triangle are in the ratio 3:4:5. The general case of ratio $a:b:c$ would prove interesting.

402. Proposed by H. PRIME, Boston, Mass.

The diameter of a hoop-shaped ring (or collar) is 24 inches at one edge and 28 inches at the other edge. A cross-section is a crescent with circular arcs of 120° and 60°, whose common chord is 4 inches long. Find its volume by elementary methods (without the use of calculus or the center of gravity).